Response to NRC Comments within
"Review of CCSP Draft Synthesis and Assessment Product 5.3: Decision-Support Experiments and Evaluations Using Seasonal to Interannual Forecasts and Observational Data" - December 19, 2007.

Page #	Recommendation	Response
2-1	Do not use prescriptive language - put recommendations at end of sections or chapter	Prescriptive language removed; key findings at beginning of each chapter
2-1	More emphasis should be placed on most recent work	Done
2-1	Draw on a broader array of sources	Done
2-1	Increase discussion of published research	Much of chapter was deleted; sections re: evolution of prototypes to products and role of evaluation in product development - in Section 2.5
2-1	Increase attention to models of innovation other than the one presented	Done in Chs. 3 and 4
2-1	Include more discussion of how models of innovation might provide useful insight for those attempting to integrate climate information into water resource decision making	Done in Chs. 3 and 4
2-2	When report is revised - chapters should be made more consistent with Exec. Summary	Done
2-2	Reconcile inconsistencies about the assumptions about the relationship between the quality of forecasts and the usefulness for decision support and address the relative priority or relative levels of investment needed.	Inconsistencies reconciled. Ch 1 states that the relationship does not necessarily exist. Sections (e.g., 2.1, 2.5, 3.2, 3.3, & 4.5) further qualify this statement
2-3	Suggests the revised document discusses evidence to support the assumption that forecasts that are better scientifically are more likely to be used. This was presented in Ch. 2 of a new NRC report, Research and Networks for Decision Support in the NOAA	This has been addressed in several sections of this report, e.g., 2.1, 3.3 and 4.2

	Sectoral Applications Research Program. They also suggest that the authors further discuss that the revised document, discuss the evidence presented in the NRC report and address how to proceed toward the twin objectives of making climate information more decision-relevant and more commonly used in the water management sector.	
2-3	Reconcile inconsistencies about the assumptions about the kinds of climate information that decision makers need – they believe that it is a mistake to assume that the most useful form of scientific output is already known and that the most useful kind of scientific output might not be a forecast but a package based on forecast information	Experiments in Section 4.2.1 have related discussions
2-3	Determining which forms of scientific output are needed, and identifying and meeting decision makers' information needs, may be performed in part by continuing discussions in groups involving producers and users of climate information, along with intermediaries or information integrators working in the NOAA/RISA and SARP programs. These are logical entities to coordinate the different actors that must interact to generate and disseminate appropriate sets of end-to-end decision-support products for particular sectors in their respective regions.	This is discussed in various sections of the report. See for example: Sections 2.1, and 4.3.1 – 4.3.4
2-3 -- 2-5	Reconcile inconsistencies about the assumptions about the nature of innovation. Consider a continuous improvement model that is circular in nature rather than a linear innovation flow chart	The previous text has been deleted. Ch. 1 discusses innovation
2-4	Address needs for collecting and maintaining climate data as it affects the water management sector – including maintenance of stream gauges and adequacy of observation coverage in situ in mountainous regions of the Western U.S., etc.	Addressed at several places in report, e.g., Section 2.4.2.1
2-4	Consider ways that these needs might be met by coordinated efforts among federal agencies, possibly including both space-based and in situ observations.	Augmentation of real-time stream gauging networks is discussed in SAP 4.3
3-1	Make audience for the document and its recommendations more explicit and address recommendations as much as possible to specific parts of that audience	See Preface
3-1	Make it easier for readers to locate the places where the prospectus questions are answered	See Table P.1 in Preface
3-1	Prospectus Question: What are the SI forecast/data products currently available? Ch. 1 covers this extensively, providing valuable information based on the literature. However,	See Sections 2.2. and 2.3 for discussion of currently available

	there should be some clarification about what is "currently available."	SI forecast/data products
3-2	Prospectus Question: How does a product evolve from a scientific prototype to an operational product? Ch. 1 provides little or nothing on the evolution from prototype (i.e., experimental research inside or outside government agencies) to operational products.	Section 2.5.1 covers this topic in general and more specifically for the NWS
3-2	Prospectus Question: What steps are taken to ensure product is needed and will be used in decision support? Ch. 1 says little on this topic because there has been little conversation with users of information about what they require when designing forecast products.	We now cover parts of this issue in Section 2.5.2
3-2	Prospectus Question: What is the level of confidence of the product within the science community and within decisionmaking community? ... We caution against strong suggestions that the spread of ensemble members for a particular climate model gives a meaningful estimate of confidence. ... Although they provide some insight into decision-making criteria, climate projections based on scenarios should also be distinguished clearly from probabilistic forecasts.	The issue of forecast confidence is covered in Sections 2.2.3 and 2.3. We no longer discuss long-term climate projections
3-2	Issue of overall quality of prediction tools is not adequately addressed. Only accuracy, which is a feature only of deterministic forecasts, was addressed. Probabilistic skill measures, such as reliability and resolution, are also important. The WMO has developed a set of recommendations on forecast verification: the Standardized Verification System for Long Range Forecasts (SVSLRF). We recommend that WMO efforts in this regard be reviewed, consulted, or at the very least mentioned.	Sections 2.1 and 2.5 now discuss methods that forecast producers and users might use to evaluate forecast quality. We no longer discuss climate projections
3-2 – 3-3	Prospectus Question: Who establishes these confidence levels and how are they determined?... Confidence is defined primarily by the community that produces the forecast information. This so far one-sided approach can be improved.	Section 2.2.3.1 addresses this question
3-3	General recommendation – it would be helpful to have authors reference specific difficulties in proposing their recommendations (e.g., "based on what we know about issues related to inequity in use of climate forecasts . . .").	Done
3-3	Prospectus Question: What SI (e.g., probabilistic) forecast information do decision makers need to manage water resources? The chapter reviews research regarding the difficulties water resource managers experience in using climate forecasts. It would be helpful to have these difficulties presented in the summary, as it might help to focus discussions in Ch. 4.	Per Ch.1 – water decision makers are varied covering diverse locations and spatial scales; Chs 3 &4 have examples of how info has been used

3-4	Prospectus Question: How much involvement do practitioners have in product development? The chapter describes the rise of science citizenship and knowledge-to-action networks as potential sources of deep involvement by practitioners. These concepts should be expanded on and referenced in Ch. 4 when thinking about practitioner involvement.	Section 2.5 has discussion of the role of evaluation in forecast product development. Also, see case studies and networks in Chs. 3 and 4
3-4	Prospectus Question: How much involvement do practitioners have in product development? The chapter describes the rise of science citizenship and knowledge-to-action networks as potential sources of deep involvement by practitioners. These concepts should be expanded on and referenced in Ch. 4 when thinking about practitioner involvement.	See Sections 4.3 and 4.4
3-4	While the material in this chapter is highly relevant to the overall goal of SAP 5.3, it lacks references from the literature…	References added
3-4	Prospectus Question: How does a product evolve from a scientific prototype to an operational product?... It would help to focus this discussion as much as possible on what is known about how climate information has been transformed by users into operational products. ... The report should present and cite existing evidence on the role of users in the transformation of scientific information into operational products.	See Section 2.5
3-4	… the conceptual framework used to discuss innovation in this chapter is rather deterministic in nature (i.e., the innovation itself determines its construction, use, etc.) and may give the impression that innovations mainly affect those who adopt them. … How do producers receive feedback on products they produce? How are ideas for new products generated, particularly by users? What about any "fixes" to the innovation?	The role of evaluation in forecast product development is now discussed in Section 2.5
3-5	Prospectus Question: What steps are taken to ensure that this product is needed and will be used in decision support?…Typically, scientists are content with data collection and analysis or perhaps coming forth with a new innovation based on analysis of science-driven questions, but they do not fully appreciate the importance of truly engaging the user community. … it was difficult to determine whether or not the writing team was expressing concerns that science users are not effectively incorporated into the process.	The role of evaluation in forecast product development is now discussed in Section 2.5
3-5	An unaddressed issue in relation to making climate forecasts useful is the likelihood of increased need for information about climate variability and change because of larger	Ch. 1 has been added and these changes are addressed there

	changes going on in the society…The document needs to provide some context related to demographic and other societal changes as background to discussing the kinds of innovation needed.	
3-5	Prospectus Question: What is the role that SI forecasts play and could play? The chapter reviews a limited range of innovation models that might be relevant, but it does not address this question directly.	See Ch. 1
3-5	Prospectus Question: How does climate variability influence water resource management? This issue is addressed obliquely in discussions related to issues of scale in hydrologic decision making. It could be addressed more directly by considering what kinds of innovations in water management might be advantageous, given the development of some skill in forecasting climate variability.	See Ch. 1
3-6	Clearly indicate that the focus is meant to be on SI forecasts—climate variability, not climate change … clarification as to the intended focus, throughout the document, would be helpful.	See Section 1.1; repeated throughout report
3-6	Prospectus Question: How does a product evolve from a scientific prototype to an operational product? While implicitly covered in places, it maybe helpful to address the role of NOAA's Transition of Research Applications to Climate Services program. It may also be helpful to be explicit about the roles of NOAA and other CCSP agencies in the cases presented.	See Section 4.3.10
3-7	Prospectus Question: What is the level of confidence of the product within the science community and within the decisionmaking community; who establishes these confidence levels and how are they determined? Ch. 4 focuses on confidence as it relates to credibility, trust, and risk perception. In doing so, it usefully broadens the discussion of the types of confidence involved in decision making beyond the narrower technical definition that might be inferred from the term "confidence levels" and from the treatment of the issue in Ch. 1. Still, it would be appropriate to add discussion of work, such as that by Hartmann et al. (2002), which address the importance and value of different skill measures to decision makers.	See discussions of Experiments in Ch. 4 – specifically Project INFORM and Seattle Public Utilities
3-7	Prospectus Question: What types of decisions are made related to water resources? Section 4.2 provides an overview and a table of general examples (Table 4.1). It would be	Table 4.1 now moved to Ch. 1 and is linked to discussion there

	helpful to link this discussion more closely with the presentation of forecasts and forecast uses in Ch. 1, where some specific products are mentioned.	
3-7	Prospectus Question: What is the role that SI forecasts play and could play? The discussion in first part of Ch. 4 overlaps in some ways with the Ch. 1 discussion of forecasts. Table 4.1 includes listings of general types of decisions that might include forecast information. ... Better integration of these discussions with more detailed material in section 4.6 would strengthen the report.	Table 4.1 moved to Ch. 1 and integrated into discussion
3-7	Section 4.5.1.1, under a title on climate variability, includes a summary of climate change issues drawing primarily on materials from the IPCC. This section would be a better fit earlier in a discussion of impacts and influence of climate on decision makers. This is an example of a place where the distinction between climate variability and change should be drawn more carefully.	This report concentrates primarily on SI forecasts; however, decisions (e.g., in the US southwest) must also consider longer term forecasts (See Section 3.2.3)
3-7	Comparing decision maker needs (discussed in section 4.3.1 and Figure 4.1) against the availability of forecasts (Table 1.3) highlights the generality of available information related to decision maker needs and the potentially enormous number of context-specific decisions. Perhaps this is where the point about the need for more integrators could be advanced more forcefully.	See new Section 4.3.5; also 4.5.1 – need for grounded theory in case studies
3-8	Prospectus Question: What SI (e.g., probabilistic) forecast information do decision makers need to manage water resources?... The text also addresses the importance of the timing of forecasts but not the spatial scale of needs.	See Section 3.2
3-8	Prospectus Question: How do forecasters convey information on climate variability and how is the relative skill and level of confidence of the results communicated to resource managers? The issue of how to communicate information through collaborative engagement with decision makers receives a great deal of well-documented attention. Other work on communicating risk and uncertainty, such as covered in past NRC reports (e.g., 1989, 1996, 1999b), should be elaborated.	See case studies in 3.2.5. e.g., Red River and El Nino/Lower Colorado cases; section; 3.3.2; and South Florida case in 4.2.1
3-8	Prospectus Question: What are the obstacles and challenges decisionmakers face in translating climate forecasts and hydrology information into integrated resource management? Ch. 4 considers this topic in depth, although the discussion is somewhat	See Section 4.3

	fragmented across sections.	
3-8	Prospectus Question: How much involvement do practitioners have in product development? Ch. 4 takes a prescriptive approach to this question by calling for end-to-end involvement of practitioners in development and dissemination of tools as an alternative to the "loading dock model" that is still used in some cases. The case studies presented do not describe the collaborative processes, perhaps because so little literature is available regarding public involvement practices in this topic area.	All experiment write-ups now pay special attention to collaborative processes
3-8	Prospectus Questions: What are the measurable indicators of progress in terms of access to information and its effective uses? How is data quality controlled? There is very little discussion of these topics in this chapter.	See Section 5.2.6
3-9	Prospectus Question: Discuss how these findings can be transferred to other sectors. This issue is not addressed in the document in any detail.	See Section 5.4
3-9	Prospectus Question: Discuss options for improving the use of existing forecasts/data products and identify other user needs and challenges in order to prioritize research for improving forecasts and products. The closing discussion … does not address issues of communicating uncertainty that are seen as priorities in the recent NRC reports... Address the need for vulnerability assessments.	See Sections 3.2.1.3 (Georgia drought case); 3.2.3; 3.3.1.2; 4.3.10 (San Pedro River case); 4.5.1 (discussion of vulnerability)
4-1	The central subject matter of this document—decision-support "experiments" in the water sector—is one for which very little evidence and analyses are available. Thus, findings must necessarily be based on the relatively weak grounding provided by case study evidence, and recommendations must necessarily be based largely on judgment. Be more explicit about this in the document.	Stated and discussed throughout report, specific examples may be found in Sections 3.1, 3.3, 4.1, 4.2.1, 4.2.2, and 4.5.1
4-1	We encourage the authors to look outside the federal government and even outside the U.S. experience for evidence on the effects of decision support activities in the water sector.	The text has been expanded – see for example: Sections 3.2.3, 3.3.1, and 4.3.6
4-1	Ch. 5 identifies seven research priorities and three general recommendations. To support these, the document should ideally demonstrate that (a) the recommended activities deserve higher priority than other activities and (b) that they deserve action by the document's audience group.	Expanded and done
4-1	The research priorities and general recommendations are all reasonable ideas and are	Now more definitive

	generally supported in the document. However, they are stated in vague language that is hard to contradict and yet does not offer clear guidance to agencies about the relative importance of different objectives or activities.	
4-1	Evidence or argumentation should be presented that private-sector organizations or local and state governments will not undertake these research priorities, so that the federal government must.	Chapter 5 addresses this issue, specifically in regards to equity
4-1 – 4-2	The appropriate balance of roles between governmental and private efforts deserves more careful consideration. … The document might therefore give consideration to an approach to climate forecast development that includes public-private partnerships in funding and developing needed information.	Done
4-2	Continued support for efforts to improve the skill in climate forecasting are crucial for improving the skill in hydrologic forecasting at seasonal lead times. This summary/ recommendation points to the need for further strengthening of climate and hydrologic forecasts. There is perhaps a perception that SI forecast skill (as measured by accuracy) is at a plateau. We recommend that the revised document indicate what advances are likely in forecast quality with increased investment.	Section 2.4 covers the topic of improving SI hydrologic forecasts, and within that section is a sub-section dealing with improving SI climate forecasts (2.4.1.3)
4-2	Support for the maintenance, expansion, and integration of dense hydrologic monitoring networks is paramount in supporting hydrologic and water resources forecasts. This conclusion is an important one, but it is far stronger than the text in the associated section in the chapter. The text may need to be strengthened with some additional references in support of this recommendation.	This is done in Section 2.4.2
4-2	Support for coordinated efforts to standardize and quantify the skill in hydrologic forecasts is needed. This recommendation implies the evolution of hydrologic forecasts from deterministic to probabilistic but then advocates accuracy metrics.	This text has been deleted in the revised Chapter 2
4-2	New efforts are needed to extend “forecasts of opportunity” beyond those years when anomalous ENSO conditions are underway. It is not clear what is intended by “extending forecasts of opportunity beyond ENSO years.” ... A clear discussion indicating that decadal trends provide additional skill to the seasonal forecasts is perhaps necessary.	Done in Chapter 5
4-3	It would be worthwhile for the authors to seek and cite additional evidence supporting the proposition that citizen science leads to improved responses to climate forecasts.	See Section 5.2.4

4-3	The claim that climate info may be integrated into the innovative water management regimes is not supported by reference to existing research.	Resolved in Section 1.2
4-3	It would be helpful to provide a summary statement about what role reframing takes in policy and behavioral change. The section on issue frames could describe how such issues as climate change come to be seen as important for public policy, so that decision support becomes an issue for government attention. However, the processes of framing are not clearly described for readers unfamiliar with the concept.	The section on Issue Frames (1.2) has been expanded
4-3	The framing of water as an "ecosystem service" (p. 134) is no longer "emergent"—it is widely accepted in the science and policy arenas …	This discussion and specific text has been removed
4-3	New venues or forums for discourse and decision making are emerging. New venues are indeed emerging, including some not mentioned in the draft. They include local governance structures, such as watershed councils, water banks, and nongovernmental organizations dedicated to water issues, especially in the developing world. Some are emerging as major players in local water resource management.	The discussion of venues has been removed. Examples of venues may be seen in experiments in Chs. 3 and 4
4-4	Knowledge-to-action networks that include locally based actors are important to implementation of innovative ideas. A more detailed discussion is needed of what knowledge-to-action networks are, how they differ from other venues or institutions (e.g., collective action, governance), their strengths and limitations, and their potential role in integrating climate science in water resource management.	We have added more on knowledge networks (including an expanded definition) in Ch. 1 and throughout the report
4-4	Equitable distribution of the benefits of water-related climate variation and change forecasts depend upon effective two-way communication to disadvantaged, vulnerable populations, and provision of sufficient resources to them to enable meaningful response. It is not clear that the problems of communication pertain only to poor and/or less technologically sophisticated users of seasonal climate forecasts. …. The document should make a stronger case that lack of financial resources is a key variable affecting the use of the forecasts—or else revise the claim.	Text has been revised
4-4	Water resource management has great unrealized potential for the inclusion of science citizenship that involves enhanced citizens' understanding of water related climatic risks; citizen participation in the development of knowledge and knowledge-to-action networks; and citizen cooperation in producing water management innovations. The document	Text has been revised

	presents a relatively strong discussion of knowledge about science citizenship but does not clearly link it to the idea of using climate information in decisions.	
4-5	There are many ways in which forecasts can improve. Skill is only one dimension of quality, whereas timeliness, understandability, and relevance are among some of the others. This is an interesting and important concept that is of direct concern to potential users; however, it does not appear to be very well supported in this chapter.	The former Ch.3 has been eliminated; this concept discussed throughout text
4-5	Climate forecasting generally has a national organization structure, whereas hydrologic forecasting is focused on a more regional scale. This finding probably does not need detailed support. However, its implications for the use of climate information in decision making are not developed either here (Ch 3) or in Chs. 2 and 4, where scale mismatch is also mentioned.	Additional text has been added to support this implication – see for example, Sections 3.2.1 and 3.3.2
4-5	For change to be attractive, improvement must be expected. Without a framework for comparing the quality of the existing system to its alternatives, the pursuit for better forecasts has been largely unstructured and based on qualitative impressions of expected benefits. Information to support this finding is included in section 3.9 (and some in section 3.7), although the conclusion regarding a framework for comparison is not strongly supported by the information provided.	The former Ch. 3 has been eliminated; sections of text are included in other chapters and have been supplemented with new material
4-5	Incompatibility with existing forecasting systems can be a major obstacle to adopting new technology into operational practice. Few resources exist among researchers or forecasters to foster this compatibility. …There is no discussion of what resources would foster compatibility or of their extent among researchers or forecasters.	We do not discuss agency resources in this product
4-5	Although known to be an effective product development tool, structured user testing is rarely done. In particular, almost no research is done on effective seasonal forecast communication. Instead, users are commonly engaged only near the end of the product development process. No support is offered for this finding in Ch. 3.	See Section 5.2.6
4-6	P. 163, line 3007: The statement that "Water management decisions can strongly benefit from better seasonal forecasts" sounds good, but it should be qualified, considering Key Finding #1 from this chapter, that skill is not the only dimension of quality in forecasts and also considering that benefits should be weighed against costs.	The former Ch. 3 has been eliminated; sections of text included in other chapters
4-6	P. 165, line 3046: The statement that innovation leads to lower cost is not substantiated	Evaluation is discussed in

	and may not hold up to scrutiny. Quite often, innovations have initial incremental costs. The ultimate result may be a more valuable output, so that the cost is justifiable, but that is not the same as lower cost.	Section 5.2.6; costs are not discussed in this section
4-6	P. 168, line 3113: Reference is made to the employment of a schoolteacher in the summer to generate regression equations. This is not documented.	Statement has been eliminated
4-6	P. 173, line 3199: The statement: "There is evidence supporting a system-wide decline in water supply forecast skills . . ." could be clarified.	Ch. 3 has been eliminated
4-6	Section 3.5 demonstrates and contrasts regionally versus centrally developed methods, user interfaces, etc. The discussion implies a preference for regionally developed applications.	Ch. 3 has been eliminated; sections of text in other chapters
4-6	P. 193, line 3640: The characterization of a motive for innovation as "laziness" here and elsewhere invites unwarranted criticism of forecasters and agencies.	This chapter has been eliminated
4-6	P. 198: The discussion of user interaction in development seems to endorse a prototype-and-test method that gives inadequate consideration to user requirements and goes against the recommendations in Chs. 2 and 4 regarding involvement of users/practitioners in developing climate science.	This chapter has been eliminated
4-6	Section 3.11 has an anti-innovation tone. It is important to recognize cost and risk, but also to balance these considerations with return. Benefits are discussed elsewhere; editing could usefully bring the discussions together.	Ch. 3 has been eliminated; sections of text included in other chapters
4-7	The material covered in the chapter generally supports the findings; however, this material and the key findings should be more tightly integrated. Reference to the many case studies, which provide much of the evidence for the document's findings, should be integrated into the text and vice versa, so that the case studies are clear illustrations supporting the analysis and key findings.	Done - Chs. 3 and 4 revised
4-7	Effective integration of climate information in decisions requires sustaining long-term collaborative research and application of decision-support outcomes. Most "experiments" in the use of climate information are relatively young, and it remains to be seen whether they can be sustained. This point comes through mainly in the case studies. It seems to rely heavily on the South Florida water management case, one of 11 cases presented. The background on the other case studies does not always provide information on how long	Cases cited in Chs. 3-4 provide more detail on time, development, and lessons are more effectively summarized

	the effort has been developing. The analysis of cases could be more effectively summarized and presented.	
4-7	A critical mass of scientists and diverse decision-makers is needed for collaboration to succeed, and there are currently an inadequate number of "integrators" of climate information for specific applications. … This point could be supported more strongly by addressing and highlighting this issue in the case studies and in the text, where the emphasis is more often on broad inclusiveness.	See sections 4.3.2 and 4.4. Also see revised New York City, Paleo-climate, fire-prone forest cases in Ch.4
4-7	Forums and other means of stakeholder engagement must be adequately funded and supported by decision-makers and scientists. The finding on forums seems to be supported most strongly by the discussion in Ch. 2. In Ch. 4, it is embedded in the discussion of boundary organizations. Given the emphasis placed on the value and potential of boundary organizations, is not clear why this seemingly narrower point appears among the key findings, whereas a finding about boundary organizations does not.	Fixed in key findings in new Ch. 4 and in Sections 4.3.5 and 4.4
4-7	Effective decision support tools must be "end-to-end" useful, meaning that they engage a range of participants, including those who generate them and those who translate them into predictions for decision-maker use. This point is a bit confusing as written.	Fixed in new sections 4.3.2 – 4.3.3
4-7	Good seasonal forecasts are an important tool for bringing scientists and water decision makers together. The tone of this statement is entrepreneurial, as though seasonal forecasts open the door to a new market. Perhaps this point relates to the first conclusion, about long-term collaboration.	See section 3.3.1 – especially cases on SE U.S.A., and NE Brazil; also RISA discussion in 4.3.2
4-7	Customizable tools—rather than generic services—are the most important products needed by decision-makers. …The comments about the need for efforts that allow communities and other groups to develop their own capacity are mentioned but not developed in this chapter.	See Seattle Public Utilities case (Section 4.2.1) and sections 4.3.1 and 4.3.2 (Australia-US case comparison)
4-7	P. 229, lines 4342 to 4346, lists a number of consequences of changes in streamflow. The connection is not clear to NOAA's SI forecasts, in the sense that it is not clear that improved forecasts from NOAA will do much to help with these issues.	This line has been deleted
4-7	P. 240 lists 4 major challenges to decision-support systems: ... The evidence that these are important challenges is not made explicit. Also, this list does not address the claim about	Fixed in new section 3.2.4

	wealth made in Ch. 3. The claim that decision-support information providers have difficulty communicating with each other (lines 4593-4594) contravenes the experience of some such scientists. Also, which of these challenges are most profound and enduring, or which can be addressed effectively by the actions of federal agencies.	
4-7	P. 246 (bottom) and 247 (top) identify 3 reasons that managers may not use climate forecasts. There is documentation for these reasons but no discussion of another potentially important reason: that the expected payoff from using the forecast is relatively small.	Fixed in 3.2.4 and Ch. 3 Cases studies on Yakima Basin and El Nino /Colorado
4-7	The case studies of "decision support experiments" are characterized on P. 257, line 4837, as being on "employing climate information." However, the first example of the Rio Grande Silver Minnow is about how climate information might help in the analysis, not how it was employed. Also, the Delaware River Basin example is about the potential of the use of climate information, not in its actual use. Such examples should be reconsidered and not used unless they add to the main points of the chapter.	Rio Grande Silver Minnow & Delaware RB cases deleted – all cases make specific mention of how climate variability is central
4-7	The discussion of how climate variability influences water resource management (pgs 238-239) actually addresses only the effects of climate change and cites only IPCC reports as sources. There is a large number of more geographically detailed studies of the impact of climate change on hydrology and water resources …	See experiments in Section 4.2.1
5-1	The division of content between Chs. 2 and 4 can be confusing. The flow might be improved by putting the discussion of context in Ch. 2 and the findings from decision support experiments Ch. 4 with the Ch. 3 material moved into another chapter or an appendix, this could considerably improve the presentation.	See re-structured Ch. 4 case treatment; Ch. 3 now contains an analytical discussion
5-1	In this chapter, the level of technicality is varied. There is occasional jargon, much of it mentioned in specific comments below. The organization needs work, and the chapter could definitely be shortened—perhaps by half. The communication is appropriate and accessible but, due to the current length and organization, some messages may get lost.	Ch.2 (formerly Ch. 1) has been substantially reorganized and shortened
5-1	Distinguish the time scales of forecasts/projections. It would help to have clear descriptions of how forecasts of different timescales are made—different inputs are necessary to determine "signal" (predictability).	Done in Section 2.2
5-2	Some relevant points to consider: The value of SI decision-support systems to climate	Because we limit the focus to SI

	change adaptation. In theory, awareness and preparation for SI variability can contribute to adaptation to climate change. However, it would be useful to specify the decisions that SI forecasting does not address that require longer time-scale information and to be clearer about the relevant time scales: 10 years? 50 years?	data and forecast products, we say little about longer time scale planning
5-2	Shorten the discussion of forecast skill.	Done
5-2	Section 1.4.1.1, Some Basic Concepts Regarding Forecast Skill, could be dropped. ... This could be replaced by a short section on the metrics of forecast skill that describes correlation and perhaps something probabilistic, as well as the differences between real and potential predictability.	Agreed – a short discussion of forecast skill is now in Section 2.2.3
5-2	Information in section 1.4.4 should be absorbed into 1.4.3	It has been incorporated into other sections
5-2	There is a lot of repeated information between 1.4.2, Sources of Hydrologic Forecast Skill, and 1.4.5.1, Skill of Seasonal Water-Supply Forecasts. Perhaps it would be more economical to not separate "sources of skill" from "skill" but have those be a single section—one section for climate and one for hydrology.	We now have one section for hydrology (2.2) and one for climate (2.3)
5-2	Skill of Climate Forecast-Driven Hydrologic Forecasts also has much redundancy. Skill of forecasts is the same concept, whether they are statistical or dynamically driven. If these need to be broken out into separate subsections, have one follow the other.	Section 2.2.3.3 now covers the topic of "skill of climate-driven hydrologic forecasts"
5-2	The section on skill of long-term climate projections has little on skill assessment; the section could be shortened quite a bit.	Deleted to keep focus on SI issues
5-2	Why does climate come after the hydrology in section 1.4? It would seem to make more sense for climate to come first.	Because many hydrologic forecasts are made without climate forecasts, the hydrologic forecasting section is first
5-3	Forecast accuracy is a deterministic measure, but much of the discussion of the use of forecasts emphasizes their probabilistic nature. The discussion of skill should include the concept as applied to probabilistic forecasts.	See Sections 2.1 and 2.5
5-3	Expand the section on skill of seasonal climate forecasts.	See I Section 2.3.2
5-3	Improve the section on observational networks and data products.	See Section 2.4.2
5-3	F1.1 and F1.2 could be dropped or replaced by something available from CPC ...	Deleted Figure F1.2 and revised

	Specifically, on F1.1, “lead time” is the time between release of the forecast and the start of the forecast target period.	the description of forecast lead times
5-3	Table 1.2 doesn’t add much to the discussion.	Table 1.2 has been deleted
5-3	F1.3 is not particularly useful... Keep F1.4 and F1.5 and add URLs to their captions.	F1.3 has been deleted; URLs have been added to all figures
5-3	F1.6 caption should make clear that this is a “POE Map” (add URL?) or else interested parties will never find it on the CPC site.	The figure captions have been updated
5-3	F1.7 could be deleted. The F1.8 caption could indicate that the Probability of Exceedance graphs are based on climate division data.	Done, old F1.8 is now in Figure 2.18
5-3	F1.9 and F1.10 could be deleted.	Deleted
5-3	F1.15-F1.18 all show examples of hydrological forecasts with associated uncertainties. Could they be combined into a single 4-panel figure …?	Combined in Figure 2.5
5-3	F1.25 is confusing and doesn’t add much to the discussion.	Deleted
5-3	This chapter focuses on the context of decision making. Although these issues are critical, they aren't all captured in this chapter. For example, risk perceptions and risk communication strategies, both discussed in Ch. 4, are also part of the context of decision making. These concepts are not fully developed in the Ch. 4 discussions.	See experiments discussed in Chs. 3 and 4
5-4	The discussion of the “prior appropriation doctrine” is not very clear.	Text has been removed
5-4	In discussing the communication of climate science … the authors reference the “deficit model” but don’t talk about other communication models and research.	Text has been removed
5-4	The discussion of institutional response, adaptation, and learning in relation to climate science opens with reference to the work of Baumgartner and Jones (p. 129) but does not follow up very systematically.	Text has been removed
5-4	This chapter focuses on innovation in the context of federal agencies responsible for developing climate forecasts. Much of the chapter does not directly engage with the insights developed in other chapters about various kinds of disconnects between what forecasters produce and what users want or need.	Ch. 3 has been eliminated; sections of text included in other chapters
5-4	Much of the chapter seems more like a sidebar than part of the main flow of the argument about decision-support needs and experiments.	Ch. 3 has been eliminated; sections of text included in other chapters

5-4	The kinds of innovation that are the focus of this chapter—innovations in forecasting apparently developed without direct connection to user needs—do not fit well with the issues raised in Chs. 2 and 4. … Discussion of user needs in the document, in whatever chapter, should provide some context related to demographic changes (population, geographic density, immigration and risk, etc.) that may further change needs for climate projections, particular on long time scales, and perhaps also for better characterization of uncertainty in the projections.	Ch. 3 has been eliminated; sections of text included in other chapters. The context for change is discussed in Ch. 1.
5-5	Until near the end, the chapter proceeds without recognition that (as noted elsewhere in the document), federal science agencies often lack understanding of the needs of users and of how to appropriately integrate them… The way this chapter is written makes it difficult to determine if the authors are raising concerns related to the ineffective incorporation of users into the process or continuing to write from a model that does not fully recognize the challenges of user engagement.	Ch. 3 has been eliminated; sections of text included in other chapters. See experiments in new Chs. 3 and 4
5-5	There are some apparent references to comments made by attendees at a workshop. It would be helpful to know more about the methods used to collect information, including at the workshop or conference. However, such anecdotal information cannot substitute for a discussion of the published research on this topic.	See P.4. In addition, published research citations have been added
5-5	The organization of Ch. 4 needs to be revisited to reduce redundancies and treatment of the same topics in multiple places. In addition, in several instances, the contents of the sections do not correspond closely to the central questions identified in the subheadings. The case studies do not make a clear effort to develop the major themes and observations made in the text or to support the key findings of the chapter.	Complete re-organization of Ch. 4 by subdividing into two chapters; case material lessons are drawn into text in both Chs. 3-4 of revision
5-5	Carefully review language for consistency and accuracy, so that climate variability and climate change do not appear to be used interchangeably and projections are not confused with forecasts.	Done.
5-5	This chapter suffers from too much technical jargon that is not clearly related to the context of water resources.	The text has been changed
5-5	The term “decision-support system” should be given a clear definition for the water resource management context.	Fixed - See Sections 1.2, 3.1, 4.2